

SCIENCE.

FRIDAY, APRIL 23, 1886.

COMMENT AND CRITICISM.

AT A TIME when the interest in the industrial organization of society is so great as it is at the present moment, it seems proper that *Science* should do its part in giving an opportunity for the free discussion of the views of any who have made especial study of social questions. It is claimed by the leaders of the working-classes, so called, that the real advances in society organization are not led by the *doctrinaires* of the schools, but by hard-fisted workingmen, who know more of their physical and intellectual wants than they do of logic. These self-asserting leaders compliment the professors upon their well-rounded sentences, giving a history of what has been accomplished, and sketching what may be the outcome of the future, but they look upon the schoolmen as little more than scribes. Despite this lowly position to which the professors of political science are assigned, there can be no doubt of the necessity of giving the reading-classes as good an opportunity as possible for appreciating the present condition of social science and for understanding the questions which are now demanding solution. Before venturing upon the wide field of sociology, it is well first to present a clear statement of the tenets of political economy as they are advanced by the writers of the times. There exists in this country, as well as abroad, a body of students, principally young men, who, after pointing out the continued progress in the tenets of political science as time changes society, insist that the at present, or recently, held dogmas are not dogmas at all, but must yield to other rules of expediency involved by the changing condition of industrial activity.

Of course, it is well understood that one main difference between this new school and the old is in asserting the desirability of greater interference in industry on the part of the state. Somebody might say that this idea has come from Germany, where the state initiative is so paramount in all enterprise; but the adherents of

the new school repudiate the assertion that their movement is a German movement, and claim that the discontent with the application of antiquated doctrines made itself felt in the valley of the Po, the heart of New England, and on the banks of the Thames. In a word, they say that the times are ripe for a decided renovation of the tenets of political economy; and it is with a view of giving this school an opportunity of propounding the fundamental principles which they think should rule at the present time in that science, that a series of articles has been arranged to appear in *Science*. This series begins in the present number with one upon 'The change in the tenets of political economy with time,' by Mr. Edwin R. A. Seligman of Columbia college. Others will follow by Prof. E. J. James, on 'The state as a factor in economics;' by Prof. R. T. Ely, on 'Ethics and economics;' by Prof. H. C. Adams, on 'The idea of property as an economic category,' showing how this varies with our ideas of what is best suited to the times; by Prof. J. B. Clark, upon 'The limits of competition, natural and artificial;' by Prof. R. M. Smith, on 'The methods of investigation in economics;' and by Prof. Simon Patten, on 'The effect of the consumption of wealth on the economic condition of society.' The article in the present number, by Mr. Seligman, is intended to present a review of the history of the industrial organization up to the present time, and to indicate in what direction the further development may take place. The other articles of the series will probably be accompanied by criticism from the pens of those belonging to the so-called orthodox school.

SEVERAL VIOLENT TORNADOES in Minnesota and Iowa, on the afternoon of April 14, proved unusually destructive to life and property on account of finding towns in their way. The description of them in the associated press reports is exceedingly poor, by reason of the reporters' unsuccessful efforts to do rhetorical justice to the sad occasion; but it may be gathered that there was a number of separate tornadoes occurring at about the same time, and following the customary south-west to north-east path, though there is confusion in the statements with respect

to this last point, and that in the neighboring districts there was a violent thunder-storm with heavy rain and hail. On consulting the daily weather-maps for April 14 and 15, a well-marked 'area of low pressure' is found moving north-eastward from Wyoming, over Dakota, into the Winnipeg district; a very abnormal turn of the isotherms shows how the winds on the south-eastern side of this 'area' carried warm air far up the Mississippi valley, and brought about the strong contrasts of temperature and moisture that generate violent local storms. These tornadoes were therefore *normal*, or like the average of their class, in every respect—except, perhaps, in occurring farther north than is usual at this time of year.

In review of this, there seems to be ground for the desire so generally expressed that the signal service should give some warning of the probable occurrence of tornadoes, at least in such a way that the inhabitants of towns in the exposed districts may be on the lookout for the approach of the dreaded funnel-cloud. The reports state that in the open country there was little loss of life, as the storms came by day, and persons generally saw them in time to take refuge in the tornado-cellars with which nearly every farm in that region is provided. But in the towns, where persons remain more indoors, and where clouds near the horizon are not easily seen, tornadoes too commonly arrive unperceived till the roar of their winds tells that there is no time for escape; and here some early intimation of the impending danger should be given. The warnings based on the conditions shown in the morning weather-map might be announced as experimental for a season, so that a public trial of their value could be made. Towns at least could be reached by telegraph and telephone in all parts of the Mississippi valley by noon on the days of danger; and the saving of lives in some places would compensate for a good deal of needless anxiety caused by warning towns that escape destruction. There seems to be no way whatever of saving property that lies in the path of the storm.

ONE HAS ONLY to glance at a bibliography of astronomy during the present century to become impressed with the fact of two very marked impulses to investigation in that science, given by the discovery, first, of the planet Neptune in 1846,

and, second, of the satellites of Mars in 1877. The latter has given rise no less to a series of popular and educational books and treatises on astronomy, in many languages, of which, it would seem, the end is not yet. These have had all degrees of worth, as their production has been participated in by authors of all degrees of information and capacity, from those who have the scantiest of reason for writing any thing whatever, to astronomers of the maturest experience, both as teachers and as investigators. The author of the work to which we call attention in a subsequent column is not unknown in our country. His early years as an astronomer were spent at Parsonstown, Ireland, in charge of the mammoth reflecting telescope of the Earl of Rosse, to which post he was appointed in 1865, at the age of twenty-five years. Dr. Ball became astronomer royal twelve years ago; and he has attained no little fame as a lecturer, having appeared before the leading learned institutions of Great Britain. Also in 1884 he lectured before our own Lowell institute, Boston, and in January last the honor of knighthood was conferred upon him.

In view of these facts, the developments in regard to his unacknowledged appropriation of the work of others assume the greater importance. In the *Nation* a fortnight or two ago, attention was directed to certain passages in 'The story of the heavens,' which Dr. Ball had borrowed bodily from Professor Newcomb's 'Popular astronomy,' with evidently no intention of ever making a proper return; while, in our present issue, it becomes apparent that he has paid a like compliment to Professor Young's admirable treatise on 'The sun.' Every one who reads it must thank Dr. Ball for a fascinating book, a very accurate one too, and he has made excellent use of his pilferings; but it seems as if he might have made a freer use of inverted commas, or confined himself, if we may borrow from Mr. Lowell, to 'pillaging the dictionary.' And this leads us further to an uncompromising denunciation of a reckless, extempore sort of book-making, too common nowadays, and which cannot be too strongly condemned. The publishers, in their struggle to meet the insatiate cry for something new, something that will sell because it is new, are as much to be blamed as authors; and the people even more, for creating a demand for these loosely woven fabrics. It is, however, a demand

which, soon or late, must cease; for, while many buy, few read, and they the close readers who make quick work of the loose author. If it is a necessary stage of our evolution, it may be hoped that the relay is not far removed.

GOVERNMENT SURVEYS.

THE proper co-ordination and management of the different government surveys, in order to secure in the most economical manner the results for which they were created, has been and yet is the subject of considerable discussion, and of diverse views among those interested. The consolidation of the geological surveys has prevented much of the clashing that formerly inevitably resulted, and at different times the national academy has been called upon to propose plans for the relations that should exist between the different bureaus. The chief ones proposed, as the readers of *Science* are aware, are, 1°, that the secretary of the Smithsonian institution should be placed in control: 2°, that there should be a cabinet officer, a secretary of science and industry, who should be charged with all the different bureaus. Prof. W. P. Trowbridge, in the issue of the *New York Star* for April 13, urges the establishment of a permanent commission, which should be competent to understand the different works, and have sufficient time to examine them yearly in detail. As he further says, there can be no question but that, in the appropriation of money by congress for any purpose whatsoever, the objects and aims to be accomplished by such appropriation should be definitely and fully known; and funds for any public works of a continuous character should never be dependent upon personal urging by the heads of bureaus, and all this should be within the province of a central co-ordinating authority.

He believes that a properly organized permanent non-political commission, such as that known as the Regents of the Smithsonian institution or the Lighthouse board, and in which should be represented the executive heads of the bureaus, the legislative branch of the government, and the scientific men of the country, would be an efficient safeguard against misdirected expenditures, faulty schemes or projects, and the duplication of work by two or more bureaus. It is not at all certain that a cabinet officer, with his political tenure of office, would be sufficient to co-ordinate the different surveys, except in so far as he would serve as a fiscal administrator, and as a medium between the scientific bureaus and congress or the executive. Political considerations would make it improbable that such a head could always be

found who should possess the varied scientific and other qualifications that would be required to determine the scope, the field of work and investigation, and the methods to be pursued for each branch of scientific work.

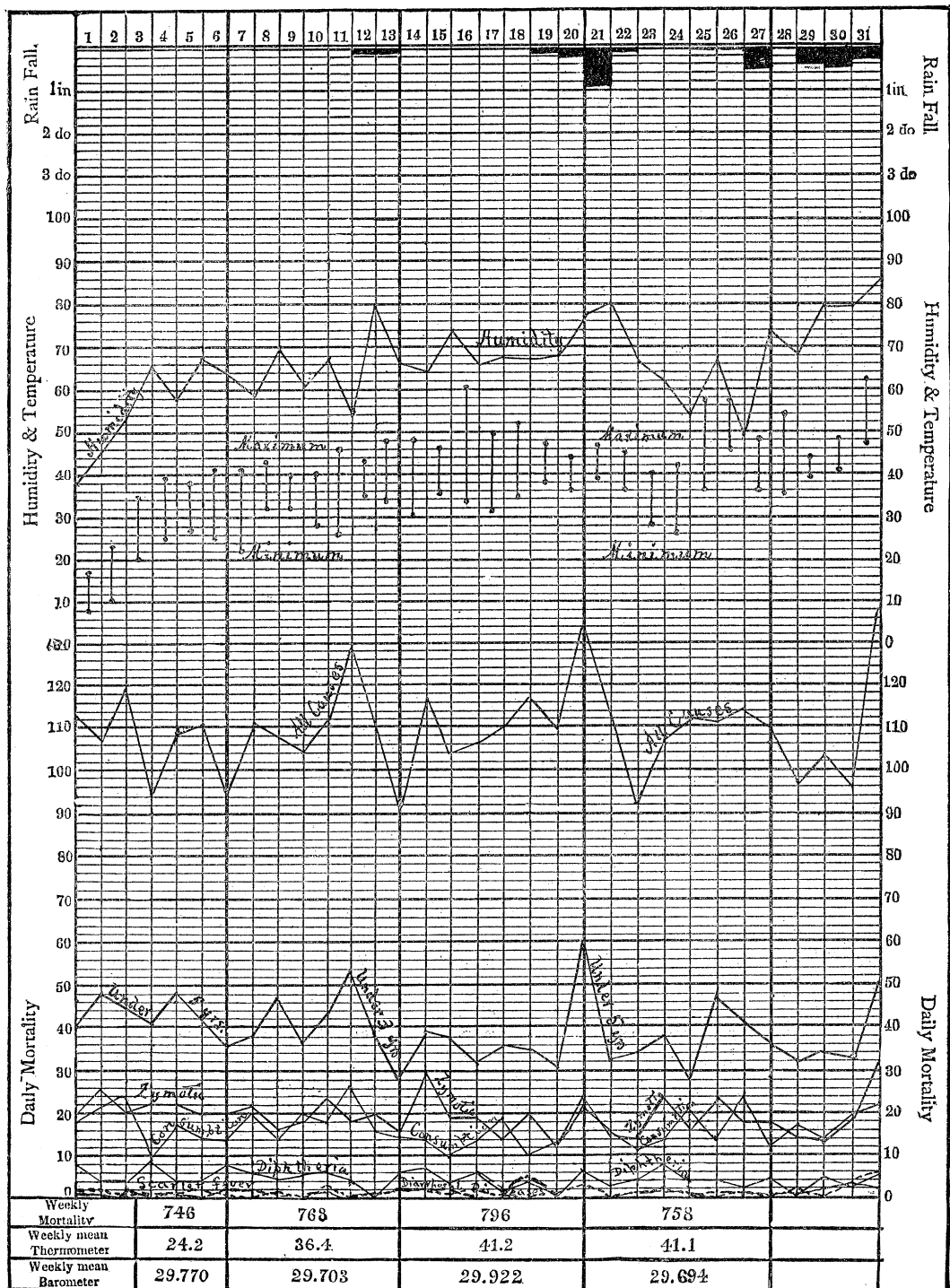
The executive and scientific details, as he rightly says, of any one of these bureaus, are enough to tax to the full extent of his powers the most skilled expert in those branches of scientific and practical knowledge which belong to the objects represented by the bureau. For this reason he deprecates any attempt to consolidate the different bureaus, and especially the coast and geodetic survey, whose work has been so fruitful of practical and valuable results for so many years, with any other.

The unfortunate shortcomings in this survey during the past year have given currency to numerous false and exaggerated rumors, which have tended to produce an injurious result, not only upon the public mind, but upon congress. Professor Trowbridge urges the injustice of including in general condemnation all the different bureaus on account of the errors of individuals in one branch, and yet more justly cites the long years of faithful and highly valuable public services that have been rendered by the great body of officers and attachés of the coast survey, who have grown up in the service, and who have not for a moment been included in any recent accusations.

HEALTH OF NEW YORK DURING MARCH.

WE continue in the present number the graphic representation of the daily mortality in New York, which was commenced in *Science* in the number for March 19. In February the greatest mortality from all causes of disease was during the tenth day, when 118 persons died: during March this was exceeded on four days, running up to 137 on the last day of the month. During the twenty-eight days of February there were 2,767 deaths; during the same period in March there were 3,054 deaths, — an increase of 277: if to this are added the deaths which occurred in the last three days of March, we shall have 3,392 representing the mortality of the past month, — an average of nearly 110 each day, or about 5 persons every hour.

The number of deaths of children under five years of age has increased as compared with February; there has also been an increase in the zymotic class and in consumption; while the mortality from diphtheria and scarlet-fever is less. Diarrhoeal diseases have carried off 32 persons, as compared with 33 in the preceding month.



The coincidence between the lines of scarlet-fever and diarrhoeal diseases, to which attention was directed in the number of *Science* already referred to, is equally marked this month: in fact, they run so nearly parallel, that it is often impossible to distinguish them. The summer mortality has not yet commenced to show itself, but many weeks will not pass before we shall see its line gradually rising higher and higher, until it reaches its height in midsummer.

The meteorology for the month presents some interesting features. The rainfall was considerably less than in February; in the latter month 4.89 inches having fallen, while during March there were 2.83 inches, the actual time in which this amount fell being 2 days 20 hours 40 minutes. During the sixteen years 1869-84 this amount was exceeded in every year but four, so that March, 1886, was, in comparison with other years, a dry month.

Another point of interest in the meteorology of March of this year is the absence of snow. But an inch fell during the entire month, and that on the twenty-seventh day. During the period of sixteen years already referred to, so small an amount fell in only five years, while in some of the years the quantity was very great; notably in 1870, when 9.63 inches fell; in 1875, 15.25 inches; and in 1883, 10 inches.

It will be remembered that in February the highest reading of the thermometer was 52° F., and the lowest—4° F. In March the maximum temperature was 62° F., and the minimum 8° F., the monthly mean for March being some 31° higher than that for the preceding month.

The population of the city of New York on March 1 was estimated to be 1,424,903, and increases presumably 799 each week.

POPULAR ASTRONOMY.

In the 'Story of the heavens,' Dr. Ball presents to the popular reader an extremely entertaining account of the discoveries, researches, facts, and theories, of a science which, in a general way, is of interest to a larger class of people than any other department of learning. The book is specially directed to the non-astronomical; the style is strong and vigorous; and many points are elucidated in so striking a manner that even the professional astronomer, if modest enough, can get many a good suggestion from it.

Ambiguities and misstatements of fact are quite entirely absent. Dr. Ball appears to be rather

less certain than the facts warrant, that the sun-spots are depressions; and he would find few astronomers, in this country at least, who would agree with him that the late Professor Watson probably discovered an intra-mercurial planet or planets during the eclipse of 1878. In parts of his work the historical method is pushed to the extreme. The complex theories of our astronomy will doubtless appear in the least difficult form if viewed in the light of the logical order of their dawning upon the philosophic mind; but the attempt to insist on this method of treatment appears, in some instances, to have led Dr. Ball into an unnecessary multiplication of wordy paragraphs. While thoroughly interesting and delightfully told, his 'Story' is, for all that, a pretty long one; and we cannot but think that it would have been better received, not to say more carefully read, if, by some such omissions as these, Dr. Ball had sooner brought it to a close.

Works on popular science, often a mere retailing at second or third hand of the labors of the professional investigator, are not infrequently filled with such misrepresentations of these labors as to be utterly misleading to the learner, not to say wrath-inspiring to those scientists whose work forms the unwilling subject of the story. Dr. Ball commits no offence of this sort: he is one of these investigators himself, but his own researches are not brought into undue prominence. We should, however, take exception to his account of the transit of Venus of 1882 as seen at Dunsink, where no observations of marked importance could be made,—an account which, therefore, cannot give a sufficient and characteristic view of the magnitude of the very extended operations conducted elsewhere on that occasion. We find no allusion to the abundant series of photographs of that transit, obtained by the American parties, which, it is safe to say, constitute the most important and successful record of a transit of Venus ever secured.

In some other parts, also, the 'Story of the heavens' is not well balanced. There is, perchance, the best of reason for being dissatisfied, or rather unsatisfied, with the present state of solar research. In the chapter on the sun, we find an exceptionally full description of the solar spots; but the question as to what they are is dismissed in a word. The progressive theories of the constitution of these objects form a most important contribution to the history of astronomy; and many a page in the book might better have been devoted to an outlined statement of these theories, and of what the spots, to say the least, seem likely to be. We should make much the same criticism of the author's treatment of that

important but mysterious phenomenon, the zodiacal light.

No inconsiderable number of persons sufficiently interested in astronomy to read a book of this sort desire to become themselves observers; not with reference to making contributions of value to the science, but simply for their own advancement and edification. Early in his work, Dr. Ball has an interesting word for such readers, suggesting work well worth doing, and for which only an opera-glass is required. Why not have elaborated this idea more fully farther on, and with reference to various celestial objects within ready reach of slender telescopic means?

We are glad to see the care with which an abounding index has been prepared: it contains something like twelve hundred entries, and covers no less than eleven pages of the book.

In the last chapter, when treating of the tides, Dr. Ball is at his best. And by tides are meant, not alone the rise and fall of the sea as we note it to-day, but the term is used in its broadest sense, and the vast problems of tidal evolution dealt with in a wholly captivating style. This new departure in mathematical astronomy, as Dr. Ball justly terms it, is fully elucidated, and the non-mathematical reader owes him many an obligation for this clear and elegant exposition of the profound mathematical researches of Professor Darwin.

The illustrations are, as a whole, the best we have seen in any book on popular astronomy. A good many of them are new, a good many are borrowed with full credit, and yet others are borrowed without any credit. To the last class belong a number appropriated from Newcomb's 'Popular astronomy,' notably those on pp. 78 and 214 of the latter work, which are reproduced on pp. 104 and 228 of Ball. Presumably the charge of plagiarizing the text accompanying these illustrations would be sustained with difficulty; but it would be interesting to know how much time elapsed between Dr. Ball's reading of this text, and the writing of his own paragraphs on the effect of gravity on a projectile, and on the toothed-wheel method of determining the velocity of light. In our way of looking at it, subtracting the smoke from the lamp, and five teeth from the wheel, and supplementing the man's head with one shoulder and a mustache, fail to establish one's right to an illustration otherwise successfully 'conveyed.'

But Dr. Ball has not confined his attentions to a single work. In filling out his chapter on the sun, he found that something already written by somebody else would save him the drudgery of a page here and there, and he appears to have had

no compunction in calling it his own. A few paragraphs from Young's 'The sun' and from Ball's 'The story of the heavens' are subjoined:—

YOUNG (p. 118).

"The average life of a sun-spot may be taken as two or three months; the longest yet on record is that of a spot observed in 1840 and 1841, which lasted eighteen months. . . . While some spots are thus long-lived, others, however, endure only for a day or two, and sometimes only for a few hours.

"The spots usually appear not singly, but in groups— . . . Very often a large spot is followed upon the eastern side by a train of smaller ones; many of which, in such a case, are apt to be very imperfect in structure, . . . When a large spot divides into two or more, as often happens, the parts usually seem to repel each other, and fly asunder . . . velocities of one thousand miles, and even more, are by no means exceptional.

"At times, though very rarely, a different phenomenon of the most surprising and startling character appears in connection with these objects: patches of intense brightness suddenly break out, remaining visible for a few minutes, moving, while they last, with velocities as great as one hundred miles a second.

"One of these events has become classical. It occurred on the forenoon (Greenwich time) of Sept. 1, 1859, and was independently witnessed by two well-known and reliable observers, Mr. Carrington and Mr. Hodgson, . . . Mr. Carrington at the time was making his usual daily observation upon the position, configuration, and size of the spots by means of an image of the solar disk upon a screen, . . . Mr. Hodgson, at a distance of many miles, was at the same time sketching details of sun-spot structure . . . They simultaneously saw two luminous objects, shaped something like two new moons, each about eight thousand miles in length and two thousand wide, at a distance of some twelve thousand miles from each other. These burst suddenly into sight at the edge of a great sun-spot, with a

BALL (p. 36).

"The average duration of a sun-spot is about two or three months, and the longest life of a spot that has been recorded is one which in 1840 and 1841 lasted for eighteen months. There are, however, some spots which last only for a day or two, and some only for a few hours.

"It should also be observed that the sun-spots usually appear in groups, and very often a large spot is attended or followed by a number of smaller ones, more or less imperfect. It often happens that a large spot divides into two or more smaller spots, and these parts have been sometimes seen to fly apart, with a velocity in some cases not less than a thousand miles an hour. On rare occasions a phenomenon of the most surprising character has been witnessed in connection with the sun-spots, where patches of intense brightness suddenly break out, remain visible for a few minutes, and travel with a velocity of over a hundred miles a second. One of these events has become celebrated for the extraordinary character of the phenomena, as well as for the fortunate circumstance that it has been authenticated by the independent testimony of the skilled witnesses. On the forenoon of the 1st September, 1859, two well-known observers of the sun, Mr. Carrington and Mr. Hodgson, were both engaged in observation. Mr. Carrington was employed at his self-imposed daily task of observing the positions, the configuration, and the size of the spots by means of an image of the sun upon a screen. Mr. Hodgson, many miles away, was at the same moment sketching some details of sun-spot structure. They saw simultaneously two luminous objects, shaped something like two new moons, each about eight thousand miles long and two thousand miles wide, at a distance of about twelve thousand miles

dazzling brightness at least five or six times that of the neighboring portions of the photosphere, and moved eastward over the spot in parallel lines, growing smaller and fainter, until in about five minutes they disappeared, after traversing a course of nearly thirty-six thousand miles."

YOUNG (p. 267).

"... the temperature at the focus can not rise above that of the source of heat, the effect of the lens being simply to move the object at the focus virtually toward the sun; so that, if we neglect the loss of heat by transmission through the glass, the temperature at the focus should be the same as that of a point placed at such a distance from the sun that the solar disk would seem just as large as the lens itself viewed from its own focus.

"The most powerful lens yet constructed thus virtually transports an object at its focus to within about two hundred and fifty thousand miles of the sun's surface, and in this focus the most refractory substances—platinum, fire-clay, the diamond itself—are either instantly melted or dissipated in vapor. There can be no doubt that, if the sun were to come as near us as the moon, the solid earth would melt like wax."

apart; these suddenly burst into view near the edge of a great sun-spot, with a brightness at least five or six times that of the neighboring parts of the sun, and travelled eastward over the spot in parallel lines, growing smaller and fainter, until in about five minutes they disappeared, after a journey of about thirty-six thousand miles."

BALL (p. 495).

"... the temperature at the focus cannot be greater, cannot be even equal, to the temperature at the source of heat itself. The effect of a burning-glass is merely equivalent to making a closer approach towards the sun. The rule is indeed a simple one. The temperature at the focus of the burning-glass is the same as that of a point placed at such a distance from the sun that the solar disk would seem just as large as the lens itself viewed from its own focus. The greatest burning-glass which has ever been constructed virtually transports an object at its focus to within 250,000 miles of the sun's surface: in other words, to a distance of about 1-400th part of its present amount. In this focus it was found that the most refractory substances, agate, cornelian, platinum, fire-clay, the diamond itself, were melted or even dissipated into vapour. There can be no doubt that if the sun were to come as near to us as the moon, the solid earth itself would melt like wax."

By what name Dr. Ball would call this wholesale pillaging of others' books, we do not know; but it seems to us to fall little short of tallying with the work of the plagiarist. Substituting 'greatest burning-glass' for 'most powerful lens,' and adding agate and cornelian to a list of refractory substances already fully long enough for the purpose of illustration, do not show any mark of great originality, while the continued effort to conceal the theft is petty in the extreme. We have not had the time to trace Dr. Ball's possible liberties with other authors than these, but our researches thus far have left us in the mood for suggesting that the titlepage of subsequent editions of his work might with some little show of justice contain the insertion 'compiled by —.' Any one who cares to investigate further may perhaps like to judge for himself

how much of pp. 495–505 in Dr. Ball's very interesting chapter on the 'Astronomical significance of heat' (the greater part) was directly suggested by a like number of pages at the end of Professor Young's chapter on the 'Sun's light and heat.' While in another part of his book Dr. Ball alludes to Professor Young as 'the well-known authority,' etc., in the chapter in question we find no mention of the name. Professor Young would doubtless be very glad to be of assistance to Dr. Ball, but we think he is human enough to care for the graceful acknowledgment of the service.

GEOGRAPHICAL NOTES.

Dutch statistics of population.—Kuyper has recently given an interesting discussion of the population-statistics of the Netherlands. The population for the whole kingdom is found to be 121.6 per square kilometre, and 75.0 for the lowlands, and varies from 265.9 to 44.6 for the same area in different districts. The females outnumber the males by from one to two per cent. Of the population, 32 per cent are married; 61.55 per cent are Protestants, 36.02 are Catholics, and 2.04 per cent are Israelites, in religion; and, in occupation, 20 per cent are agriculturalists, 26 per cent laborers, 12 per cent merchants, 18 per cent manufacturers or mechanics, 2.5 per cent soldiers, 2.3 per cent engaged in religious, scientific, or sanitary professions. The increase of population from 1860 to 1880 varied from 12 per cent, in Limburg, to 30 per cent, in Holland proper. Of thirty-eight centres of over 10,000 inhabitants, one (Delftshaven) has doubled, seventeen have increased more than 25 per cent, and twelve others have increased from 10 to 25 per cent, during the same period. The work is supplemented by an instructive chart showing the increase of population for the period by single parishes,—a course only practicable in so small a country as Holland.

Search for mammoths in the Lena Delta.—Dr. Bunge has sent to St. Petersburg a chart of the Lena Delta, corrected during the numerous long journeys undertaken by him in search of frozen mammoths. His travels were more lucky geographically than biologically, for he found but one skeleton, and that deprived of head and one fore-leg. It had been exposed for ten years to the attacks of dogs, foxes, and natives, but had originally been covered with a thick coat of hair, which might have defended it against even the present climate of the delta, provided it could have obtained food to its liking.

Medals of Paris geographical society.—The great gold medal of the Paris geographical so-

ciety, for 1886, has been awarded to Messrs. Capello and Ivens, for their African journeys. A smaller gold medal has been given to the 'Pundit A. K.,' one of the anonymous explorers for England of upper Tibet; and medals of silver and bronze to Messrs. Bloyet and H. Mager, for African topography and the 'Colonial atlas.' The *prix Legerot* is received by M. Marche, for his explorations of the Philippines.

A new oil. — The oil of a species of bamboo of African origin is reported by the Catholic missionaries of Alima in Africa to be an excellent lubricator, and, when refined, to form a fair substitute for olive-oil in the cuisine. The new industry thus created is actually in process of development in the French Kongo region.

Ethnographic map of Asia. — Von Haardt of Vienna has sent out a prospectus of a new ethnographic map of Asia, in six sheets, scale 1: 8,000,000, total size 175 x 140 cm. The scheme includes one hundred and thirty-six ethnic divisions, to be indicated by appropriate tints and hachuring. The subscription price is placed at thirty francs. The classification adopted has its defects; but the map, which will be accompanied by a small explanatory pamphlet, to all interested in the distribution of mankind, will have great value. If successful, it will be followed by maps of other continents, on the same plan. Subscriptions are to be sent to Eduard Hölzel, Vienna, Weyringer-gasse 19.

ASTRONOMICAL NOTES.

The two comets. — Fabry's comet continues to increase in brightness, and on a clear morning is bright enough to be made out with the naked eye, though it does not reach a sufficient altitude before sunrise to be very conspicuous in the presence of bright moonlight. Barnard described it on the 8th inst. as a hazy object with a faint tail, which, in the telescope, could be traced for five or six degrees. On April 24 the comet will be in the constellation Triangulum, in right ascension $1^h 32^m$, north declination $30^\circ 3'$, and will appear above the horizon about half-past three in the morning. Its brightness is then 297 times as great as at the time of discovery. The comet is increasing its right ascension, and is moving rapidly south: at the end of April, according to Dr. Oppenheim's ephemeris, it will approach us within a fifth part of the distance of the sun, and its theoretical brightness will be nearly 500 times that at discovery. Barnard's comet is also increasing in brightness, but somewhat more slowly than Fabry's. It makes its nearest approach to the sun in the first week of May, and its nearest to the earth in the latter part of that month. The position for

the last of this week (April 24) is: right ascension, $1^h 40^m$; north declination, $39^\circ 39'$, with a calculated brightness of 62: it is nearly midway between the second magnitude stars β and γ Andromedae, and sets a little after eight o'clock. The astronomical positions we have given can readily be found upon the star-maps (map I.) given in the *Science Almanac* for last year (vol. iv. No. 99) or upon any celestial atlas.

The new nebula in the Pleiades. — The nebula discovered by the Henry brothers of the Paris observatory, upon their photographic negative of the Pleiades taken Nov. 16, 1885, has been seen — now that its existence is known — without great difficulty, by Perrotin and his assistants at Nice, and by Struve with his new 30-inch Clark objective, and also with the 15-inch at Pulkowa. Struve gives a careful description of the nebula, accompanied by a sketch, in the *Astronomische Nachrichten* (No. 2,719), and from his observations it seems probable that some of the small stars in the immediate neighborhood may prove to be interesting variables. The nebula is of a characteristic spiral form, and seems to 'escape' from the star Maia. Professor Pickering, upon the announcement of the discovery, recalled the circumstance that certain irregularities had been noticed in a photograph of the Pleiades taken on Nov. 3, 1885, at Harvard college observatory. These irregularities, which had been referred to defects in the photographic process, correspond closely with the descriptions of the nebula, and no doubt represent light photographically visible near Maia. "The explanation thus afforded, of one of the markings on the Cambridge photograph, makes the others of more interest than seemed at first to belong to them. There are indications of nebulous light about Merope; four short parallel streaks directed to the south following side are particularly noticeable, and a faint prolongation of diffuse light may be suspected towards the south, in agreement with the descriptions usually given of the visible nebula in that region. There is also a faint streak of light projecting from Electra on the following side. . . . No nebulous light is noticeable about Alcyone, Atlas, Pleione, or Taygeta."

NOTES AND NEWS.

AS stated in our 'Boston letter' of March 12, the liberality and co-operation of the Woman's education association enable the Boston society of natural history to announce that the Seaside laboratory at Annisquam, Mass., will be open to students during the coming summer from June 15 to Aug. 15, 1886. Annisquam is situated on an inlet of Ipswich Bay, on the north side of Cape Ann,

and is about three miles and a half by coach from the Eastern railroad station in Gloucester. The purpose of the laboratory is to afford opportunities for the study of the development, anatomy, and habits of common types of marine animals, under suitable direction and advice. There will be no attempt to give lectures or any stated courses of instruction. The laboratory has been in operation for four successive summers, and has fairly met the wants of a number of students, teachers, and investigators. Those who have had some experience in a laboratory, who have attended practical lessons, or who have taught in the schools, are sufficiently qualified to make use of this opportunity. The instruction and work of the laboratory will be under the immediate care of Mr. B. H. Van Vleck, assistant in the laboratory of the Boston society of natural history, a gentleman well known as a teacher, and who has also had long experience in collecting and observing at the seaside. Applications should be made immediately, and can be addressed to Mr. B. H. Van Vleck.

— The Boston *Transcript* states that Mr. Alfred Russell Wallace, the celebrated English naturalist, who shares with Darwin the honor of an independent discovery of the law of 'the survival of the fittest,' is coming to the United States on the invitation of Mr. Augustus Lowell of Boston, to deliver a course of eight lectures before the Lowell institute, in that city, beginning in October. It will be remembered that it was on a similar invitation (from Mr. Lowell's father) that Professor Agassiz first came to America, in the autumn of 1846. After completing his Lowell institute course, Mr. Wallace will lecture in other cities, and proposes to return to England in the spring of 1887. His subjects will be chosen from natural history.

— During the past week the occurrence of a large number of insects of a formidable appearance in Washington has attracted considerable attention. The following account of their habits and appearance is given by one of the entomologists of the agricultural department: This large insect of two inches and a half, or more, in length is the *Belostoma americanum* of entomologists, and belongs to the order Hemiptera, or true bugs. It lives in ponds and sluggish streams during the immature state, in which it has no wings, and is full grown in fall, remaining in the ponds during the winter. When, in the spring, the warm weather awakens them, they come forth at dark, often in immense numbers, and fly about: the sexes mate, and they return to the ponds in which the female deposits her eggs. They are

strongly attracted by light, and especially by electric lamps, under which vast numbers often strew the walks, and are crushed under foot. Their sudden appearance often creates alarm; and during the past week or two, specimens have been received from various parts of North Carolina and other southern states, the writers often in evident fear of damage from this insect invasion. But they are perfectly harmless. They are, it is true, able to inflict a very painful bite, for they are provided with a short, sharp beak; but they never do so voluntarily, and they do not live on any thing in the way of vegetable matter outside of the water. They are carnivorous, feeding principally on less powerful water-insects, and not despising an occasional fish, frog, or other bit of flesh that may come in their way. They have been just as abundant in previous seasons, but have not been so much noticed, for the reason that there have not been so many electric lights to which they could be attracted. Like so many of the true bugs, they have a very peculiar and rank smell. A number of other water-insects are also attracted to light, but never in such quantities.

— The following papers were entered to be read at the annual meeting of the National academy of sciences, which convened at Washington, Tuesday, April 20: G. F. Gilbert, The geologic age of the *Equus* fauna; T. Sterry Hunt, The Cowles electrical furnace; E. D. Cope, On the phylogeny of the Batrachia; On the phylogeny of the placental mammalia; H. A. Newton, The comet of Biela; Elias Loomis, Areas of high barometric pressure over Europe and Asia; Samuel H. Scudder, The cockroach in the past and present; James D. Dana, Biographical memoir of Arnold Guyot.

— In his annual report for 1885, the United States entomologist continues his report on silk-culture in the United States. He does not speak very encouragingly of its immediate success as a profitable industry, and thinks any stimulus given to it must needs be temporary, and that the substantial way of encouraging the industry will be by imposing an import duty on the reeled silk from foreign countries. Two stations have been established by the agricultural department during the past year for the production of reeled silk; and Dr. Riley concludes, that, with the introduction of the improved Serrell reel, the cost of reeled silk per pound may be reduced to \$4.38. The cost of several hundred pounds of reeled silk produced at the New Orleans station was \$5.90 per pound, or, as corrected for needless expenditure, \$5.35: it brought in the market \$4.50.

—The meeting of the engineers' club of Philadelphia on April 3 was spent in an interchange of views as to how to best promote a more extended discussion of the numerous subjects brought before the club. Various methods of bringing original papers to the early attention of members likely to discuss them were proposed, and the subject was finally referred to a committee. This is a serious question with most of the scientific clubs of the country, which find their meetings generally of a stiff and formal character, tending to stifle all debate.

—The chemical laboratory of Fresenius at Wiesbaden enjoys a very large attendance, says the *Chemical news*. In the winter term, 1885-86, there were 90 students on the books. Of these, 58 were from Germany, 6 from Austro-Hungary, 6 from North America, 5 from England, 5 from Russia, 3 from France, 2 from Switzerland, 2 from Holland, 1 from Luxemburg, 1 from Sweden, and 1 from Norway. Besides the director, Geh. Hofrath Prof. Dr. R. Fresenius, there are engaged as teachers in the establishment Prof. Dr. H. Fresenius, Dr. E. Borgmann, Dr. W. Fresenius, Dr. E. Hintz, Dr. med. F. Hueppe, and Architect Brahm. The assistants in the instruction laboratory were two in number, in the private laboratory twelve, and in the versuchsstation three. During the last term, besides the scientific researches, a great number of analyses were undertaken in the different departments of the laboratory and the versuchsstation on behalf of manufacture, trade, mining, agriculture, and hygiene.

—The Woman's education association of Boston has made arrangements for a course of lessons in botany by Prof. George L. Goodale of Harvard university. The course is designed to present the principal laws of life and growth of plants, and will deal especially with methods for cultivating and collecting plants for study. Each lecture will occupy about half an hour, and, as in former years, will be followed by a practical exercise in the examination of plants. These laboratory exercises are arranged for beginners, but will also serve to supplement previous courses of botanical practice. The lectures will begin on Monday, March 22, and will be given on Fridays and Mondays in the rooms of the Natural history society. Tickets for the course, at ten dollars, may be obtained at the Natural history rooms.

—It is proposed to raise a fund by public subscription for the purpose of presenting a testimonial to the Rev. H. H. Higgins of England, in recognition of the services he has rendered to the cause of education, and especially to the various departments of science during the last forty-

three years. Contributions may be sent to Baron L. Bevas, 1 Lord Str., Liverpool, Eng.

—The office of *secrétaire perpétuel* of the French academy, left vacant by the death of M. Jamin, has been filled by the election of M. Vulpian. The two principal candidates were M. Vulpian and M. Alphonse Milne Edwards, the former of whom received twenty-six, the latter twenty-four votes.

—It has long been known that petroleum existed in the vicinity of Jemsah, on the west coast of the Red Sea, about one hundred and seventy miles south of Suez; but previous explorations have produced no result. In September, 1884, a Belgian mining engineer, M. Debay, was sent to report on the possibilities of the practical working of the oil-beds, and, after much trouble, he has finally succeeded in reaching practical results. After penetrating successively through gypsum, containing veins and nests of sulphur, shale, green and blue clay, limestone, and sandstone, the drill, on Feb. 28, fell suddenly forty centimetres, and petroleum rose to a point two metres above the sea-level. On receipt of the news, Nubar Pasha arranged an expedition of experts, from whose examination there has resulted the establishment of the following facts: that petroleum undoubtedly exists; that the geological formation of the country is favorable to the existence of larger quantities at lower depths; that the store of oil is generally distributed over a large area in the neighborhood; that under existing unfavorable conditions a single source yields about two tons daily; that the specific gravity is .88; and that the spot is easily accessible from the coast, where there is good anchorage.

—The ravages of the phylloxera have, during the past year, extended into a number of cantons in Switzerland where the insect has never been hitherto observed, and have caused considerable uneasiness in the wine-producing industry. In connection with the continual extension of the fields of its devastation in foreign countries, it is of interest to note, that, in Professor Hilgard's last report of the viticultural work in California, it is stated that the habits of the insect in that state deviate from those observed in foreign countries to such an extent that the dangers of infection are much lessened. These differences in habits consist in the rarity of the winged female form, and the apparent absence of winter eggs, both probably due to the climatic influences. The mercurial vapor remedy, of which much has been hoped, has, in the hands of Professor Hilgard and his assistant Mr. F. W. Morse, failed to produce its promised results as a phylloxera insecticide.

—A new explosive has been invented by F. Redtenbacher, a mining engineer in Austria. It probably contains only the elements of ordinary powder, but in proportions determined by twenty odd years of research. This powder is brownish black in color. The advantages of the explosive, which is known as 'miline,' are its insensibility to percussion or friction, and that it can only be ignited by a spark. There exists, therefore, little danger in its transportation and preparation. It does not undergo any modification under the influence of temperature, and only ignites at 335° to 340° C. It burns with little smoke, and does not produce any deleterious gas. It can be employed exactly as powder, and, when well tamped, its effects are comparable with those of dynamite.

—Mr. A. Vogel has recently shown (*Centralblatt f. agric. chemie*) that cinchona-trees, growing in hot-houses in Europe, develop no quinine in their bark.

—King Oscar of Sweden has ordained two prize contests on oriental subjects, — one, the history of the Semitic languages; the other, a description of the Arabic civilization before the time of Mohammed. The prizes are a gold medal worth 1,000 Swedish crowns, and a sum of money equal to 1,250 Swedish crowns. The treatises may be written in Latin or German, and may be forwarded to Professor Fleischer of Leipzig, or Professor Nöldecke of Strassburg, before June 30, 1888.

—The investigation before the Massachusetts legislative committee on the subject of arsenic in wall-paper indicates that the danger has been exaggerated. Prof. C. F. Chandler testified, that, from careful experiments, under no conditions could arsenical poisoning occur through breathing arsenaturated hydrogen from wall-paper, and that the only source of danger would be from friction alone.

—Prof. L. Geiger of Berlin is about to issue a *Zeitschrift für die geschichte der Juden in Deutschland*. It will be scientific in character and treatment, and, in addition to essays and reports of research, it will contain summaries of historical materials that are difficult of access or hitherto unprinted. It will also make its bibliographical notes an especial feature.

—The Smithsonian report for 1884, just issued, contains, like the previous ones, the secretary's annual report, and summaries of scientific progress in the natural sciences, by E. S. Holden, C. G. Rockwood, F. M. Green, C. Abbe, G. F. Barker, H. C. Bolton, E. S. Dana, J. B. Marcou, T. Gill, and O. T. Mason, together with a number of miscellaneous papers on anthropology.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

New York agricultural experiment-station.

In your review of the fourth annual report of the New York agricultural experiment-station (*Science*, vii. No. 165) you deal very leniently with some of the most glaring faults of that report. This is certainly the pleasanter way; but does it best subserve the cause of truth and progress? That station is unquestionably doing valuable work for the cause of progressive agriculture, and, because of the ability thus manifested, the anxiety of the friends of that cause is the greater that its splendid opportunities should not be frittered away in a kind of work which, if persisted in, will inevitably bring about its ruin.

The fundamental mistake in the management of this station, as manifested by this report, is the endeavor to cover too much ground. The field of agricultural experimentation is so vast, that he who would accomplish any worthy result must confine his labors to a limited portion of it; but in this case so many problems have been attacked, that few receive that close and careful attention which is the first requisite of truly scientific work. The director makes frequent reference to the necessary incompleteness and unreliability of isolated tests, and does good work in showing the variability of duplicates; but the infrequency with which he collates the results of his present experiments with those previously made by himself or other equally competent authorities, and the frequency with which he disregards his own testimony respecting the necessity for the duplication of tests, intensify the feeling that the value of a large proportion of the work of this station is seriously impaired by its desultory character.

The impression, that, in much of this work, quantity is attained at the expense of accuracy, is strengthened by page after page of the report. Typographical errors are difficult to wholly avoid; but it is putting the case very mildly to say that they occur with unnecessary frequency here. This point, however, might be passed without notice were these the only evidences of hasty or careless work. In the tabulated report of the experiment in feeding starch-waste, for instance, we are left to conjecture which columns of figures relate to hay, and which to starch-meal, while no practical feeder would have been guilty of the absurdity of feeding a rich meal *ad libitum*, and following it by hay fed in the same manner, where it was desired to make a scientific test of the feeding-value of either food. Under the circumstances, the allusion to the capriciousness of appetite in the cows under test is amusing.

The fertilizer test recorded on p. 40 affords another striking example, both of the crudity of the methods employed at this station, and of the carelessness in reporting results. What would the magnificent Rothamsted experiments have amounted to, had the plots in Broadbalk field received enormous dressings of fertilizers one year, none the next, and varying quantities in the succeeding years, or if their interpreter had shown such carelessness in the summarizing of results as has been shown in giving the total quantities of fertilizers used in this case?

In conclusion, I must wholly dissent from the idea conveyed in the closing paragraph of your review,

that an experiment may have a so-called practical value and yet be worthless to the man of science. What is science but accumulated and co-ordinated facts? What fact is there which confirms, disproves, or illustrates any supposed law of Vegetable or animal growth, that is not valuable to the scientific man, and to the farmer as well? What agricultural experiment, worthy the name, but must perform this function? It is true, the farmer may be more interested in the results of the experiment, as in a comparative test of different varieties of wheat, while the scientist may be more desirous of ascertaining what constitutional peculiarity enables the one variety to surpass the other in yield; but in either case the fact that the one variety is the more productive is the stimulus of the investigation, and the methods of culture must be the same if trustworthy data are to be obtained for the use of either scientist or farmer. I do not forget that valuable facts have been learned from experiments which would be utterly impracticable in the field, and I would be the last to deny the usefulness of such work; but, until the applicability of these facts to the methods of the farmer has been demonstrated by field experiment, they are practically valueless. I do not deny that the study of isolated individuals, or of small groups of individuals, has a legitimate place in the work of the experiment-station; but, until the results of that study are shown to be applicable to the field or to the herd, they are worthless to the farmer, and equally worthless to the scientist. But this demonstration must be made by men trained to the scientific method.

C. E. THORNE.

Settlement of labor differences.

Last week's *Science* contains some views of Mr. N. M. Butler on the 'Settlement of labor differences,' which claim to be from the stand-point of 'science and philosophy,' which is explained to mean freedom from false notions and prejudices, and to be the observation of facts and relations as they are.

He says that 'we' are apt to look upon the present economic system as fixed and final. Who are 'we'? 'The fact as it is,' is that in America, England, France, Germany, etc., men by the thousands and hundreds of thousands most decidedly do not feel that way at all. Numerous American citizens known as Knights of labor have combined and organized for the express purpose of changing the present wage (i.e., private capital) system into an integral co-operative one; and, what is more, they work with earnestness, determination, and devotion to realize that end. Instead of "feeling an irresistible desire to look upon the (social evolution) process as completed, and the book of evolution as closed," they feel an irresistible conviction that society is entering on the threshold of a new form of economic organization. This belief is scientific; that is, it is based on experience carefully made and closely analyzed, as may be seen in the works of Karl Max, F. Engels, Henry George, and very clearly in that American writer George Gronlund's book, 'The co-operative commonwealth.'

Mr. Butler says something about "the ethical fact that there is a superiority of possessions." What can it mean?

Mr. Butler adds his voice to the chorus of 'arbitration' fetish-worshippers. Arbitration is to have 'magic' results. So it must, if it will harmonize the

interests that are diametrically opposed, as are those of capitalists and laborers in regard to sharing the product of labor.

But, say the 'arbitration' and 'harmony' preachers and Mr. Butler, the product is the combined result of the efforts of the capitalist and laborer. Sometimes the capitalist adds his efforts to the work of producing by direct labor, or indirectly by doing the requisite directing of the work, and sometimes he does not. When he does apply personal effort, he is entitled to reward; but that is a different thing from the profit on his capital which will go to him if he hires managers or agents, or is merely an investor or shareholder in a business he neither does nor can manage, nor in any way add 'effort' of his own to the work of production.

No, the capitalist need not work. He can (and many do) live in idleness, consuming enormously without producing at all, and, on an average, he never gives an equivalent of effort for what he gets: hence there is want of equity in the capitalistic system.

It is self-evident that no arbitration, but only a radical change of the system, can abolish this injustice; and this injustice is the cause of the 'labor differences.'

'Christian charity' will not suffice here; that is, the 'give all you have to the poor' doctrine will not do, but, rather, a modernized adaptation of the institutions of the primitive Christians, who had some primitive form of integral co-operation, for they held 'all things in common' (see the story of Ananias).

As to arbitration as a sort of palliative patchwork for making temporary compromises, perhaps it is good for that; but 'brute force,' in the form of police and militia, has to stand behind it to make capitalists keep their agreement, which they have broken in innumerable instances when it was in their interest and power.

Whether the change from the capitalistic to the co-operative mode of production will be by 'brute force' depends on the resistance the capitalists make to the course of evolution. History shows that privileged classes generally have appealed to brute force whenever their privileges were in danger.

The advice of science they do not heed. It is interest that guides them. Science, that is, our judgment of future facts by past ones, says the course of evolution of human society tends to abrogate all privileges and equalization of rights and duties. This is the democratic principle. When applied to social economy, it is termed 'socialism' or 'social democracy.' The capitalist cannot be a mere trustee without first ceasing to be a capitalist. This implies an entire change of the laws of property: hence the advice of science to labor is, Organize to make the requisite change of laws; that is, go into politics as a party to establish an economic republic, *electing* your directors of labors. That will settle all differences between capital and labor, because there will be no capitalist, and all will be laborers or starve.

CHAS. FIELD.

Eskimo building-snow.

In your issue of Jan. 15, 1886, you give an illustration of what purports to be 'hardened snow' impacted on a Mount Washington telegraph-pole by a strong gale. During the past winter I have

noticed the same formation at this station upon the anemoscope and anemometer. I would like to inquire whether the Mount Washington formation is really snow driven against the pole by the gale, or, as at this station, an accumulation of fog in a frozen state. This formation I have never observed during snow-storms, even when accompanied by winds of sixty miles and upwards, but it is of frequent occurrence when a heavy cloud envelops the peak.

T. W. SHERWOOD,
Sig. corps, U.S.A.

Pikes Peak, Col., April 15.

Quaternary volcanic deposits in Nebraska.

It was the good fortune of the writer to discover the following significant section during the last holiday vacation. It is in one of the abrupt bluffs overlooking a sharp bend of the West Blue River, in the southern part of Seward county, Neb. It exhibits the formations from nearly the general level down to the level of the stream. It is as follows: $2 \pm$ feet soil; passing into $6 \pm$ feet red gritty loam; $9 \pm$ feet stratified loamy clay, with thin streaks of small white quartz pebbles; passing into $3 \pm$ feet mostly gravel, with a few boulders of red quartzite from Dakota; passing into $15 \pm$ feet stratified loamy clay with streaks of pebbles; 6 to 10 inches of light gray earth, volcanic ashes, thinly and evenly laminated; $1\frac{1}{2}$ feet clay, darker above; below passing into 5 feet fine gray sand, with thin clay laminae 6 to 12 inches apart; $1 \pm$ foot coarse sand with pebbles and boulders of red quartzite, — greenstone, — granite, etc., with an uneven surface below; 6 feet hard greenish joint clay; 8 feet slope; water of the West Blue River.

A few rods distant a less complete but similar section shows the siliceous layer five feet thick, and it appears along the sides of a ravine at different places for several rods, showing considerable persistency. Specimens of it have been submitted to Mr. J. S. Diller of the U. S. geological survey, with another sample from Knox county. He replies, "Specimens No. 1 (Knox county) and No. 2 (Seward county) are volcanic dust. They are composed chiefly of minute angular fragments of pumiceous glass, such as is thrown high into the air during violent eruptions, and wafted by currents of air for hundreds of miles away from its source. The fragments of glass are, for the most part, clear and transparent, with few traces of crystalline matter. Besides the volcanic glass, there are numerous grains of quartz sand, which are well rounded. . . . As nearly as I can estimate, from the small quantity examined, more than ninety per cent of the whole is volcanic dust. It appears that the material is of complex origin. While there is no doubt that the volcanic dust was borne by winds nearly or quite to its destination, the rounded grains appear to be of aqueous origin, and suggest that the dust may have fallen in a body of water, where the two commingled."

Several important conclusions seem well-nigh demonstrated by this section.

1. The occurrence of important volcanic action somewhere in this region during the quaternary. The red quartzite could not have arrived in this locality before the glacial epoch. If the section eventually proves to be of a local formation, which does not seem likely, it would only make the deposition of the dust more recent.

2. The character of the siliceous deposit strongly supports the conclusion that it was dropped in a deep or quiet lake. This accords well with the deposits above and below; for the bowldery layers are, for evident reasons, referred to floating ice, and the character of stratification favors lacustrine rather than fluvial conditions: hence we are led to believe that this lake was contemporaneous with the ice-sheet which occupied the regions of Dakota and Iowa. We catch a glimpse of the joint action of frost and fire on our western plains.

3. From the location of the section, and its relation to the White River tertiary sands, which, if rightly identified, are widely exposed east of this point, it appears not unlikely that this lake was but the diminished stage of King's Lake Cheyenne. Numerous finds of these siliceous beds have been reported from the republican valley, and one as far east as Oak Creek, Lancaster county. They probably belong to this same geological horizon.

J. E. TODD.

Tabor, Io., March 20.

World time.

The last number of *Nature* contains a lecture by Mr. Christie, the astronomer royal of England, on universal or world time. With Mr. Christie's principal conclusion I fully agree, but have not much faith in some of his arguments, or in some of the results he predicts.

Mr. Christie bases one of his arguments on the ignorance of farmers, and infers, that, because the farmer cannot tell a difference of half an hour in his time, we may therefore make this difference four, five, or ten hours. But would the farmer be any better off if he should tell his wife that he wants breakfast at sixteen, seventeen, or twenty-two o'clock? Of course not. And it is not wise, I think, to base any permanent action on the ignorance of any class of men. Conditions may change; and such arguments, though they may answer for a political or military campaign, are easily overdone, and must be looked upon as only temporary.

The most vicious assumption that underlies Mr. Christie's argument, and which he has in common with some other astronomers, is this: he assumes that man was made for railroads and telegraphs, and not that these things are for man. My natural assumption would be that the chief astronomer of a great country would have a wider view of things. But we all know the liberality and influence of our great corporations, and how they deal out free wires and free service; and we have all felt this on the reception of a free telegraphic despatch when we come to the last letters, *D. H.*

Now, I say with Mr. Christie, let the railroads adopt a world time, and it does not matter what meridian they take, though Greenwich is probably the best, and let all their trains be run on this time. Then, directly opposite to Mr. Christie's proposition, let all the cities, villages, and farmers return to their local and natural time. If the railroads will do this, the most ignorant farmer will soon understand matters. I speak with confidence, because forty years ago I was a farmer myself, and very ignorant. There has been too much confusion given to this matter, and our astronomers have been too eager to sell time. They have better work to do.

ASAPH HALL.

Certain questions relating to national endowment of research in this country, and their importance.

In reply to your able critic (W. S. N., in *Science*, vii. No. 165) of my letter bearing the above title (No. 164), permit me to refer him to my articles upon science and the state, recently published in *Mind in nature*, of Chicago, and, if his interest carry him that far, to do me the simple justice of re-reading my letter in *Science* which prompted his questions,—questions which I will here endeavor to answer for him.

In the first place, let me most emphatically reiterate my opinion, that I am fully in favor of the government endowing researchers in civil life, as well as affording the proper opportunities for the successful prosecution of the labors of those scientists upon their own rolls. May I ask my critic to again peruse that paragraph in my letter that is completed with the following words, "I stand on the side of the King of Denmark, in his principle as applied to Tycho Brahe," and then ask himself if my being interrogated as to my convictions upon the question as to whether or no it devolves upon the government to aid researchers in civil life was necessary; and I think he will find, upon reconsideration, that there is no difference of opinion between us upon that point.

As to the proper ones who should receive such aid from the government, either in civil life or the services, let my critic place the correct construction on the word 'demonstrated,' when I say in the sentence he quotes from my letter, "of those persons in her employ who have from time to time demonstrated their fitness to perform certain work," and I must believe we will agree here also. Mind you, I am not in favor of promptly affording assistance to any one and every one, or to him who suddenly springs up, and exclaims, "Lo! I am a scientist, I can write a book, I believe I am an investigator and a genius." My advice to such a person would be, 'Demonstrate it, my good friend.' As to the amount of assistance the government should render to those exceptional persons in this country who have demonstrated their peculiar fitness to prosecute certain lines of research with marked success, I concur fully in the opinion of Professor Huxley, who says, "Now, the most important object of all educational schemes is to catch these exceptional people, and turn them to account for the good of society. No man can say where they will crop up; like their opposites, the fools and knaves, they appear sometimes in the palace, and sometimes in the hovel. But the great thing to be arrived at, I was going to say the most important end of all social arrangements, is to keep these glorious sports of nature from being either corrupted by luxury or starved by poverty, and to put them into the position in which they can do the work for which they are specially fitted." I quoted these excellent words nearly three years ago in the New York *Medical record*, and again in my article upon science and the state in *Mind in nature*: so there is some danger of their becoming immortalized, though I considered them immortal when they were first penned. I will say, however, that, if occasion requires, I will quote them again,—quote and quote, till they become even the battle-cry of the socialists themselves.

Regarding the progress of our nation, from an evolutionist's point of view, as I do, I must consider,

from the very limpets in our fauna, through every atom we lay claim to, our bodies and brains, our minds and our works, our institutions and industries, our opinions and our language, nay, through our very government itself,—I must consider, I say, the whole as one glorious growth and development. During this growth, that limb of the common tree which bore the crop of American scientists undoubtedly did encroach upon the government service; and to the extent of this encroachment only do I "claim a monopoly of talent in government employ."

It was from this broad basis that I attempted to write my letter upon national endowment, and I feel pained that I should have failed in anybody's eyes. My suggestions for a scientific corps for the army and navy, my papers upon science and the state, were prompted solely through the same sentiment.

Is it too much to hope that some such re-organization as the department of science that I have elsewhere suggested, may some day be an idea realized, or do I peer too far into the future, when I see other zoölogical stations scattered along both of our extensive coasts, repeating, and repeating again, the magnificent national work that has been accomplished by the staff at Wood's Holl? Or, scanning the horizon still farther, is it too much to hope that somewhere in the dim future that change may come o'er the dream of the official mind, and it, too, see the grand natural law that the nineteenth century has wrested from nature's secrets, and that the principles of evolution which are becoming more clearly defined for us every day be turned to practical use, and a little bending of the twigs be done by the government, to the extent of utilizing these evolved products for the nation's good? Then those who have demonstrated their peculiar fitness will be taken up by the government as one of her most powerful weapons; and room will be found for their strength, in this very department of science, these zoölogical stations on our coast, and similar zoölogical and meteorological stations established, as they should be, at suitable points all over our broad empire.

R. W. SHUFELDT.

Fort Wingate, N. Mex., April 8.

The American ornithologists' union code and check-list of North American birds.

By an unfortunate oversight, the committee of the American ornithologists' union on classification and nomenclature of North American birds omitted to recognize in the preface of the 'Code and check-list' the important aid rendered the committee by the gentlemen invited to share in its labors. Dr. L. Stejneger, Dr. C. H. Merriam, and Dr. T. N. Gill were present at numerous meetings, participated in the discussions, and are entitled to grateful recognition by the committee for their services.

Dr. Stejneger not only gave valuable assistance to the subcommittee on species and subspecies, particularly in relation to questions of synonymy, but was also present by invitation at most of the meetings of the whole committee, took an active part in its discussions, and contributed valuable assistance in the formulations of the 'Code,'—assistance which the committee is glad to gratefully acknowledge.

COMMITTEE OF THE AMERICAN ORNITHOLOGISTS' UNION ON CLASSIFICATION AND NOMENCLATURE.

SCIENCE.—SUPPLEMENT.

FRIDAY, APRIL 23, 1886.

CHANGE IN THE TENETS OF POLITICAL ECONOMY WITH TIME.

"IT is incontestable," says Comte, "that continuity and fecundity are the least doubtful symptoms of all truly scientific conceptions. When each new work on political economy, in lieu of presenting itself as the spontaneous sequence and gradual development of previous works, has an essentially personal character according to its author, so as to repeatedly put in question the most fundamental notions," then we can rest assured that we are not dealing with a science properly so called.

It is not the intention of the present paper to combat this statement in its entirety; for the maturer judgment of the scientific world has convicted Comte of a gross misconception as to the nature of economics. But one charge must be met,—a point that contains the very marrow of the new movement in political economy. What Comte predicated of sociology, but denied in speaking of political economy, and what many of the older school then, as now, often disregarded, is the essential interrelation between economic theories and the changing external conditions of industrial life. The modern school, the historical and critical school, holds that the economic theories of any generation must be regarded primarily as the outgrowth of the peculiar conditions of time, place, and nationality, under which the doctrines were evolved, and that no particular set of tenets can arrogate to itself the claim of immutable truth, or the assumption of universal applicability to all countries or epochs. We do not wish to disparage the work of previous economists; but, just because of our belief in the relativity and continuity of economic doctrine, we are compelled to regard much of what was at the time comparatively correct and feasible, as to-day positively erroneous and misleading. We maintain that Comte's criticism is specious and shallow; we hold that there is a well-defined thread of continuity and gradual development in the history of economic doctrines; and we assert that each period of economic life must be treated by itself, both in regard to the truth or falsity of the doctrine itself, and in regard to the applicability of the particular theory in question. Let us, then,

first give a short sketch of the history, and then draw our conclusions.

1. The science of political economy in its present form is essentially a creation of modern thought. The conditions that have given rise to its birth are peculiarly the development of the last few centuries. Classic antiquity can indeed show us several writers on economic topics; but a complete science, as we understand it, was an impossibility, because the whole environment was of a nature to preclude speculation of this kind. The one great fact which pervaded the whole national life in Hellenic antiquity, for instance, was the institution of slavery. In Greece the home of almost every rich freeman was a great complex. He owned the land, the house, the slaves; and he produced at home, on the premises, all the necessary articles of consumption, which again, in cases where exchange was desirable, were taken to market by his own slaves, and sold as his own property. This complex of possessions was called in Greece *oikos* (originally, 'a house'), and the word 'economics' (*oikos* and *nomos*, 'rule') primarily denoted the method of managing this property, thus including domestic as well as political economy. But there was no fundamental distinction between real and personal property, between movables and immovables, between land and capital, as in modern times, because the same individual always owned both. There was no distinction between labor and capital, because labor was regarded as a part of capital, because the laborer was property, because the slave was put in the same category as land and other commodities. Land-owner, capitalist, employer of labor, who are to-day sharply distinguished in production, were thrown into one in antiquity. The slave being a part of this complex, no independent theory of wages could arise, since there were no wages; the land-owner being the capitalist, no theory of rent could arise; the capitalist being the employer of labor and the transporter of goods to market, no theory of interest and profits, no conception of wages of superintendence as a separate share in distribution, could arise. The *oikos* is therefore a fact of the most fundamental importance in Greek life, and furnishes the clew to all the theories of Aristotle and Xenophon, which, without it, are incomprehensible and seemingly illogical.

The second distinguishing mark of Greek life was the general conception of state. The present century is the age of individualism: the Hellenic epoch

was what might be called the age of collectivism. There the state reigned supreme: the individual as such was swallowed up. His time, his property, his life, belonged in the last instance to the state, which might demand it at any time. The only occupation worthy of a full citizen was that of attending to public affairs. Statecraft and politics, athletics and military exercises, engrossed the chief moments of every Grecian, and left him neither time nor inclination for the pursuit of manual labor. This conception of the state was perhaps carried to an extreme in Sparta, where, as is well known, the meals were eaten in common, the children educated together under the superintendence of the state, and the marriage relation subordinated to considerations of imagined political necessity.

In Rome the matter was not far different. The economic conditions were for many centuries essentially the same as in Greece, and the ideas, even as advanced in the code of Justinian, bear evidence of the incomplete development of economic theory. Slavery, the low estimation of manual labor, and imperial absolutism, were the distinguishing characteristics of national life; and under such conditions a science in the modern sense was rendered impossible. The Romans, however, had their physiocratic school, during the empire, in the shape of the agrarian writers, — *scriptores de re rusticâ*, such as Varro, Columella, etc., — who attempted to stem the tide of national decay, and to recall the Romans to a sense of their former strength, by sounding the praises of agriculture, and by proving the economic as well as moral shortcomings of the system of servile labor.

2. The growth of the Christian church—the substitution of a great monotheism for the numerous polytheisms of antiquity; the change from the old cults, which were but national religions or consecrations of the national idea, to the new worship, which was international, not national, and intended to embrace all humanity—brought in its train the most cardinal changes. This is, of course, not the place to recount the changes produced in economic relations by the church teachings: it will suffice barely to mention the total alteration in the treatment of the poor, the improvement in the condition of woman, the conception of the dignity of labor hand in hand with the institution of holidays for the workmen, and the efforts for emancipation of the slaves. The patristic authors even went so far as to preach practical communism, although their object, far from being that of inciting the rabble to resistance, or of sowing the seeds of discord, was simply to recall the wealthy to a sense of their own obligations, to preach the gospel of fraternal love and

charity, to remove some of the hideous moral enormities with which the later imperial civilization was honeycombed.

But it was not until the scholastic age that any distinctive economic doctrines were formulated. The increase of industry and commerce in the eleventh and twelfth centuries, the rise of the municipalities and the growth of the town-guilds, craft as well as merchant, lent an increased impetus to the consideration of economic topics, — an impetus still further strengthened by the discovery and annotation of Aristotle's 'Politics and economics.' The subject of money, for instance, received a careful treatment, and the so-called Gresham's law was as well known to the authors of the fourteenth and fifteenth centuries as it is to-day. The two great doctrines, however, that dominated all mediæval economy, were those of usury and of reasonable price. The prohibition of interest was founded, not on Aristotle's plea that money was barren, nor even, except at the very first, on the injunction of St. Luke, *Mutuum date, nihil inde sperantes*, but on a complicated and artificial legal distinction, drawn from the Roman law. The theologians based themselves on the glossators and legists, and the wordy strife about 'fungible' and 'consumptible' things continued for several centuries, until finally settled by Salmasius, Turgot, and Bentham. But the doctrine influenced all mediæval speculation: it was applied not only to loans, but to transactions of all kinds; it was the pivot about which the theories of price, of exchange, of banking, and of trade, swung; and an acquaintance with its provisions is indispensable to a correct comprehension of mediæval economic life.

Of still greater importance, however, was the doctrine of *justum pretium* ('reasonable price') as expressed in the writings, and exemplified in actual life. The middle ages were a period of customary, not of competitive prices; and the idea of permitting agreements to be decided by the individual preferences of vender or purchaser was absolutely foreign to the jurisprudence of the times. The 'higgling of the market' was an impossibility simply because the laws of the market were not left to the free arbitrament of the contracting parties. Under the supposition that the interests of the whole community would be best subserved by avoiding the dangers of an unrestricted competition, the government interfered to ordain periodical enactments of customary or reasonable prices — reasonable, that is, for both producer and consumer. Tabulated tariffs and official regulations of all things, from beer to wages, filled the statute-books; and it would have seemed preposterous for the producer to ask as much as he

could get, or, on the contrary, to demand less than his neighbor, and thus undersell him. The great offences of mediaeval trade in England, for instance, were regrating, forestalling, and engrossing, — buying in order to sell at enhanced prices, intercepting goods on the way to market to procure them more cheaply, and keeping back wares purchased at wholesale in order to strike a more favorable bargain subsequently. But, above all, great solicitude was shown for the interests of consumers, and every precaution was observed to preclude the possibility of overreaching the public. It was deemed of paramount importance to watch over every stage of production; and the whole institution of craft-guilds was nothing but an adjunct to the municipal administration in the endeavor to attain this end. Erroneous and misguided as was some of this legislation, there is no doubt that it was the outgrowth of moral ideas, and to a certain extent justified by economic necessities. *Iustum pretium* was the manifestation of a great moral principle, and until the decay and disintegration of the guild system, through the growth of competition and the development of a distinctively capitalistic class, set in, the mediaeval doctrines and institutions were undeniably well suited to the exigencies of economic life.

3. The so-called mercantile system was simply the manifestation, in one particular direction, of the general mediaeval conception of national polity. The commonly accepted notions of its teachings form nothing but a distorted caricature, and it would indeed be surprising if a set of ideas upheld by the leading minds for many generations should be such a tissue of absurdities as some would have us believe. The earliest writers, such as Bodin in France (1578), and Stafford in England (1581), had their attention called to the general disarrangement of industry and prices, caused in great part by the influx of bullion from America and by the gradual development of competition, as against custom. Their ideas, as expanded in the seventeenth century by English and continental economists, were simply to foster industry, to increase population, and thus to bring about a general prosperity. The great writers of the times never entertained such an absurd idea as that wealth consisted of money; they, indeed, had a somewhat exaggerated opinion of money as an evidence of national prosperity, and some of them laid undue weight on the importance of the 'balance of trade' argument: but their ultimate aim was national aggrandizement through industrial as well as commercial supremacy. The economic policy of Colbert, of Frederick of Prussia, does not at all correspond with the accounts

usually advanced, and was in reality dictated by considerations of the highest statesmanship, and in many respects eminently well fitted to the necessities of the period. The prominent English writers of the seventeenth century, such as Child, Petty, North, Locke, etc., entertained opinions on the subject of international trade, which closely approximate to the principles laid down by Ricardo and Cairnes in this century. Their ideas on the nature of national wealth, moreover, were in the main correct; and they perceived and explained with lucidity the shortcomings of the industrial system, which was then gradually becoming unsuited to the altered conditions of the period. The English authors struggle for free trade, in the sense of freedom of exportation; the Italian Serra (1613) invokes the principle of 'liberty of contract'; the Frenchman Montchrétien (1615) does not think of subordinating agriculture and industry to commerce.

The mercantile system, even in its crudest form, showed that statesmen and authors began to form some conception of a national economy. Practical economic systems can never be entirely divorced from political considerations; and it is these political considerations alone which enable us to understand some of the fundamental mercantilistic notions, such as the desire for increased population or the 'balance of power' argument. The mercantile system formed a fitting pendant to the political attempts of the absolute monarchy, which the new political science has taught us to regard not only as a necessary, but as a most salutary, step in the advance from mediaeval feudalism to modern constitutionalism. The doctrines themselves underwent a gradual modification, and in their final form simply taught that the real advantage lay in the stimulation of production and the greater activity of industry. The mercantile system had, at the time, undeniably a certain historic justification.

4. In the eighteenth century, however, the system, with its restrictive measures and its illiberal policy of national exclusiveness, had become antiquated. Inquisitorial custom-houses and tariff wars were multiplied; industry was fairly throttled by minute regulation of details: in France alone four large quarto volumes were filled with complicated, unintelligible, and contradictory regulations of manufactures. The confusion was heightened by the excesses of the monopolistic companies and the degeneration of the craft-guilds, which now, far from being welcome auxiliaries to the municipal administration, had become oppressive, exclusive bodies, with an hereditary, caste-like organization. What wonder, then, that a sect of men should arise who

sought refuge from this intolerable pandemonium of perpetual interference in the soothing doctrine of absolute liberty? The times were ripe for a reaction,—a reaction in every sphere of life, political, religious, economic. In politics this was ushered in by Rousseau, in philosophy by Voltaire and the encyclopedists, in economics by the advent of the physiocrats. The great significance of the physiocrats, as their name denotes, is the belief in the natural order of liberty; their tenets of *produit net* and *impôt unique* being subordinate doctrines, which grew out of their endeavor to rehabilitate agriculture, and bring the dissolute classes back to a sense of primitive simplicity. Just as the mercantilists had laid stress on the national element, applying the principles of domestic economy to political life, so, on the other hand, the physiocrats represented the universal, the cosmopolitan, the international view. In that confused progeny of stoic philosophy and Roman law as nurtured by the continental jurists and philosophers, and known as the law of nature, Rousseau found the life-blood of his *contrat social*, the support of his revolutionary theories. And the same misconception led Quesnay and Gournay to formulate the laws of industrial society as eternal and immutable truths, which it was the function of man to expound, but which it would be utterly impossible—or, if possible, utterly ruinous—to change or tamper with. *Laissez-faire, laissez passer*, is the key which unlocks all economic puzzles. The ‘be quiet’ system, as Bentham calls it, is the sole panacea for human ills, the only hope of social regeneration. Give free play to the natural laws of liberty and equality, and prosperity will soon shine in all its refulgence on the expanse of national life.

The great statesman and economist, Turgot, undoubtedly made a move in the right direction in the celebrated six edicts of 1776, which abolished the guilds and the *corvées*, and reformed the corn-laws. The *economistes*, indeed, were indefatigable in their opposition to the abuses of the powerful to the privileges of the few. In the place of restriction they demanded freedom, in the place of nationalism they demanded cosmopolitanism, in the place of paternal government they demanded individualism. In every respect the sheer opposites of their predecessors, the physiocrats, beyond all cavil, sounded the just note of discontent with prevailing theories and institutions, which had become utterly unsuitable and anomalous; but their enthusiasm for reaction made them overshoot the mark, and go to the other extreme. An excellent work was done in clearing up the old errors as to the function of government, but it is almost too much to expect

from the physiocrats the consciousness that they also were going too far. They could not be expected to foresee that the absolute reign of the ‘let alone’ system would produce, as it has done, evils almost as great as those against which they battled. Physiocracy was a timely and necessary movement. The ardor of its advocates in the search for economic laws enabled them to throw great light on the subjects of the division of labor, capital, wages, interest, and profits; and the only fault that can be found with them is, that, in unduly exaggerating the possibility of individual self-interest as an emanation of natural law, they laid the germs of a doctrine which was in future decades to prove an obstacle to a well-rounded social reform.

5. It is well known that Adam Smith, the greatest of all economists, owed much to the physiocrats, and that he was for some time a disciple of Quesnay. Many portions of the ‘Wealth of nations,’ in fact, are translations of and excerpts from the French writers; although Smith, of course, opposed their minor doctrines of the sole productivity of agriculture, and of the single tax on land,—a project which had already been formulated in the preceding century by John Locke. But Smith was far more than a slavish follower of the physiocrats. He took, indeed, many thoughts which he found in other authors, English as well as French; but he individualized their passing remarks, he placed them in such a connection that they became invested with a new significance, he clothed them in such a garb that they must henceforth be regarded as his own progeny. And this, after all, was a work of genius, for it is given to no man to be entirely original: every one is the product of the times, of the *zeitgeist*, and the ideas of the period are unconsciously reflected in the individual. So with the idea of liberty in Smith: he too was feeling the indefinable influence of the new current of thought, already partly expressed in Hume and Cantillon. Had he never seen the physiocrats, his ideas on liberty would have been the same, for both were an unconscious emanation of the spirit of the age.

Smith’s thoughts were formed on the very threshold of the industrial revolution. In 1758 James Brindley built the first canal between Liverpool and Manchester, in 1769 the barber Arkwright re-discovered Wyatt’s method of roller-spinning, in 1770 Hargreaves perfected the spinning-jenny, in 1776 Crompton patented his mule founded on the water-frame, in 1765 Watt discovered the use of steam as a motor power, and in 1785 Cartwright invented the power-loom. The house system of industry, which had supplanted

the hand system at the beginning of the eighteenth century, was now itself supplanted by the factory system. The conditions of English life were fast outgrowing the swaddling-clothes of official omniscience and governmental sciolism. In the town where Smith labored there were numerous protests, by individuals and by societies, against the antiquated policy of the government. It is not surprising, then, that, after a careful *résumé* of the shortcomings of the mercantilists' commercial policy and of the physiocrats' agricultural policy, Smith should have concluded with the celebrated passage, "All systems, either of preference or restraint, therefore, being thus completely taken away, the obvious and simple system of natural liberty establishes itself of its own accord. Every man, as long as he does not violate the laws of justice, is left perfectly free to pursue his own interest in his own way, and to bring both his industry and his capital into competition with those of any other man or order of men."

And yet Smith was too broad-minded to hold this doctrine without any qualifications, for he possessed a far truer historical spirit than many of his successors. He upholds the navigation law of Cromwell as a measure of the wisest statesmanship; he defends the necessity of export duties in certain cases; he confesses that the interests of individuals "in any particular branch of trade or manufacture are always in some respects different from, and even opposite to, the interest of the public." It cannot be denied that Adam Smith's philosophy was to a great extent correct: his doctrines most clearly showed the impolicy of the combination laws, of the acts of settlement, of the statutes which fixed the rates of prices and wages. Smith's whole work consisted in pulling down the rotten fences which obstructed the path of the artisan, the farmer, and the merchant, and we of to-day cannot be too grateful for the salutary impulse he thus gave to all economics. But what was then good, is not necessarily good to-day. We must not make Smith responsible for the faults of his disciples. The 'Wealth of nations' was written at a time when there was need of such a reaction as it undertook to initiate. Before building the new, it is imperative to tear down the old, and Smith certainly succeeded beyond his anticipations in demolishing the old principles. But since his time new conditions have arisen. The factory system, then in its infancy, has revolutionized industrial life, and has brought in its train problems which scarcely existed in 1776. The machinery of commerce and transportation is vastly more complex, and cannot be regulated by any such simple methods of *laissez-faire* as were possible when Smith wrote.

It is, of course, not fair to take him to task for failure to perceive the consequences of his doctrines when applied under different conditions; but it is legitimate to protest against the acceptance, at the present time, of his views, in so far as they are one-sided and inadequate. Smith's work is by far the most important ever written in the science; but we must not, on that account, bow down blindly before its author, and meekly accept all his conclusions. Had we lived in 1776, we would certainly have been followers of Smith: did Smith live in 1886, he would no less surely have been in the vanguard of the new school.

6. On the lines thus marked out by the great Scotchman, Malthus and Ricardo continued the work. The one clarified all ideas on the subject of population, and threw light on some doctrines left obscure by Smith: the other sought to elucidate the complex problem of values, applying his peculiar theories to the law of rent,—of which he was the formulator, not the originator,—and being moderately successful in his treatment of currency problems. The outcries of late raised against the personal character of these two eminent economists are utterly groundless. Mackintosh expressly tells us, "I have known Adam Smith slightly, Ricardo well, Malthus intimately. Is it not something to say for a science, that its three great masters were about the three best men I ever knew?" And yet the exclusive predominance of abstract methods brought the two great followers of Smith to many faulty conclusions. In the case of Malthus, we have, as a result of his justifiable indignation against the poor-laws and the fantastic dreams of a Godwin, this curious spectacle. A benevolent clergyman, full of compassion and sympathy for the poor, feels himself impelled to declare that no possible efforts of government, no possible social movements or spontaneous plans to better their condition, can be of any avail. To the state he says, 'Hands off; ' to the philanthropists, economists, and statesmen he cries, 'All you can do is ineffectual; ' to the workmen themselves he declares, "Refrain from combination, the sole method of bettering your condition is to practise self-restraint." And in this remedy he himself puts little faith. The main causes of the distress he declares to be "to a great extent, and for a certain time, irremediable." And all this because of his firm belief in the natural laws, the immutable principles of an abstract political economy. Truly a sad spectacle, which would be absurd if it were not so sorrowful! It might be termed a philosophy of despair, a sad starting-point for nineteenth century economics. Fortunately modern investigation and recent events have proved the ground-

lessness of such a system of negation; they have shown that social reform is possible, and that rational improvement need not be checked by the bugbear of the wages-fund which Malthus and his followers set up as an absolute fact; they have demonstrated that other classes besides the workmen have duties to perform, and that the solution cannot be reached by declaring the laborers themselves the sole cause of all their own unhappiness and dissatisfaction.

Ricardo, again, with all his keen and penetrating analysis, based his apotheosis of free competition on insufficient foundations. The half-century that had elapsed since Adam Smith began his work, had converted the slow industrial change into a revolution. In the domain of international trade, indeed, the conditions had become peculiarly favorable for an application of Smith's doctrine, and Ricardo did an admirable work in paving the way for the anti-corn-law league of the forties. But the semi-metaphysical, the *a priori* element in the 'Principles of political economy and taxation,' produced a set of unreal and inapplicable conclusions. The theory of economic progress which formed the result of his labors is as unsubstantiated as it is pessimistic. Profits must fall, rent must rise, and wages must remain about stationary, not keeping pace, on the whole, with the advance of wealth and prosperity. In this there are some grievous misconceptions, not the least being the assumption of 'natural wages' and 'natural profits' varying in an inverse order to each other. But here, again, Ricardo is the child of the particular epoch in which he lived. His assertion that profits rise as wages fall, and *vice versa*, has lent the socialists of to-day the great argument of the necessary antagonism of capital and labor. Ricardo, curiously enough, passed over this, and drew the conclusion that the interests of laborer and capitalist are identical as against their common enemy, the land-owner. Wages and profits go hand in hand, opposed to the 'landed interest.' Who does not see that the peculiar conditions of England at this time were responsible for a theory which has lately been reformulated and exaggerated by George? Ricardo, indeed, was no enemy of the working-classes: his opponents, who term him 'a heartless worshipper of mammon,' 'the founder of the Hebrew-Caledonian school, thinking of nothing but the interests of money,' are, of course, guilty of an absurd exaggeration. Just because he wished for the welfare of the toiling masses, did he attempt to remove the obstacles in their path. He was an able advocate of the repeal of the combination laws in 1824. But his efforts were limited to removing the legislative obstacles:

he did not yet perceive the necessity of removing the obstacles that were growing out of the system of free competition itself. During the years in which he matured his conclusions, the evils of the factory system had not yet become thoroughly developed or widely known. Ricardo's ideas were not yet entirely unsuited to the period, even though we of to-day must confess that his desire for abstract generalizations, founded on insufficient postulates, initiated a method of reasoning in economics, which led to many fruitless discussions and hair-splitting distinctions. We will not go so far as Jevons, in saying that "that able but wrong-headed man, David Ricardo, shunted the car of economic science on to a wrong line;" but we do maintain that his exclusive use of hypothetical methods—i.e., a system based on the hypotheses of natural law, coupled with a belief in the infallibility of self-interest—produced serious exaggerations and results, not in accord with the actual facts. Ricardo's theories are like rough diamonds, incrusting in dirt and sand; it is the duty of the economists of this generation to pare down and polish the edges, ridding them of their excrescences, disclosing in some instances the flaw in the jewel within, which renders it worthless, but showing in other cases that the core at least is sound, and capable of reflecting the light thrown on it by the lamps of recent experience.

The so-called orthodox school of England—McCulloch, Senior, James Mill, etc.—pursued an opposite course. Instead of clearing up, they increased the confusion; in lieu of modifying Ricardo's conclusions, they attempted to embed them more firmly in the unsubstantial foundations. One proposes to make of the science a mere 'catallactics;' another wishes to call it 'chrematistics,' a mere science of exchanges. All agree in venerating the absolutely immutable natural laws, which it is sacrilege to tamper with. The factory laws they deride; the trades unions they howl down; the growing abuses of the factories and the great corporations they have no eye for. "Labor is a commodity," they say: "if men will marry, and bring up children to an overstocked and expiring trade, it is for them to take the consequences. If we stand between the error and its consequences, we stand between the evil and its cure; if we intercept the penalty, we perpetuate the sin." They quote with approval Dignan's phrase, "To augment the annual production, to carry it as far as it can go, and at the same time to free it from all restraints,—that is the great object of government." No thought of any higher aims, of a more equitable distribution—simply the greatest possible increase of material commodities. And even the noble Cobden was

permeated with the narrow political philosophy of the time. But the labor question proved the rock on which the old school split. They lost supporter after supporter who saw the hollowness of the arguments, the inadequacy of the results. The professors and journals, in their very exaggeration of such opinions, began to be discredited. The science itself was fast losing its hold on thinking men, who were not satisfied with mere abstractions and what seemed to them practical obstructions to progress. The laborers looked upon economics as a science necessarily hostile to themselves; and this, too, notwithstanding the eloquent pleas of Bastiat, who attempted to prove that all interests are harmonious by natural law, and that it would be the height of folly to interfere with this beneficent progress. The economists were optimistic: the laymen grew pessimistic.

7. The first isolated mutterings of discontent came from France. Simonde de Sismondi already, in 1819, accused the orthodox school of "forgetting the men for the things; of sacrificing the end to the means;" of producing a beautiful logic, but a total forgetfulness of man and human nature. The positive side of Sismondi's arguments was, however, far less strong than the critical portion; and his protests, hence, fell on careless ears, although he led a small band of enthusiastic followers. Friedrich List, again, with his theory of nationality and of productive forces, did a good work in calling attention to the historic, relative element in all economic progress, but vitiated the effect of his 'national system' by turning it into an exaggerated plea for protection. The socialists, such as Weitling, Marlo, and Proudhon, uttered energetic and effective protests against the prevailing systems; and even in England able men like Thompson and Jones wrote large works to countervail the exaggerations of the orthodox school. But the new ideas first obtained a truly scientific basis about thirty-five years ago, when three young German economists — Roscher, Knies, and Hildebrand — proclaimed the necessity of treating economics from the historical stand-point. They initiated the new movement whose leading principles may be thus formulated: 1. It discards the exclusive use of the deductive method, and intonates the necessity of historical and statistical treatment. 2. It denies the existence of immutable natural laws in economics, calling attention to the interdependence of theories and institutions, and showing that different epochs or countries require different systems. 3. It disclaims belief in the beneficence of the absolute *laissez-faire* system; it maintains the close interrelation of law, ethics, and economics; and it refuses to acknowledge the adequacy of a scientific explana-

tion, based on the assumption of self-interest as the sole regulator of economic action.

An entirely new impulse was thus given to scientific research. Freed from the yoke of a method which had now become sterile, the new school, devoid of all prepossessions, devoted itself to the task of grappling with the problems which the age had brought with it. The amount of actual knowledge, historical and theoretical, imparted by Schmoller, Held, Brentano, Wagner, and the host of younger economists, cannot be underestimated or neglected by any student. In Italy the entirely new spirit infused into economics is attested by a number of able writers; and even England has not lagged behind in the work. With Fawcett and Bagehot the last important representatives of the old school practically disappeared; Mill himself had gone through an evolution, and was sincere enough to express his disbelief in the old economy, and to a certain extent in his own book; while Leslie, Toynbee, and our contemporaries, Marshall, Ingram, and Cunningham, are thoroughly imbued with the new ideas.

What, then, has this historical *résumé* established? It has proved, in the first place, the relativity of economic doctrines. To maintain that all previous generations and countries have erred, and that we alone possess the truth, is an egotistic assumption, based, moreover, on the untenable hypothesis of the identity of human nature and the similarity of outward conditions. Our economic system is not necessarily the only true one: there will be and have been as many systems as correspond with the current conceptions and institutions. Many of our economic ideas are based on the postulate of absolute right of property, or on the supposition of the necessary division of producers into employers and employees. And yet we know to-day that private property is not an absolute natural right, but that it is, on the contrary, a comparatively recent conception, an institution justifiable only on the grounds of expediency, and whose extent may be limited again by these same considerations of expediency; it is a question, not of right, but of arrangements which will inure to the greatest possible social prosperity. Again: the distinction between employer and employee is not a necessary one, inherent in the nature of things: the very basis of the mediæval guild system, in so far as it had a distinctive characteristic, was the identity of employer and employee, the amalgamation of capitalist and laborer in the same individual. How, then, can we speak of the unchangeable laws, good for all times and all climes? In antiquity we have seen an economic system based on the complex household and the undoubted omnipotence of

the state; in the middle ages we have found a civilization founded on the all-engrossing conception of *justum pretium*; at the beginning of the nineteenth century we notice a *régime* of pure individualism, of unalloyed free competition. Must we not confess the relative justifiability of the early municipal regulations of trade and industry, or the bullionist idea of hoards of precious metals, in a time when warfare was perpetual and bills of exchange unknown? The truly historical mind will acknowledge, with Adam Smith, the immense benefits of Cromwell's navigation act, but will rejoice, with Cobden, at the repeal of the corn-laws; he will praise, with Gournay, the attempts to unshackle industry, but will deplore Ricardo's opposition to the factory acts; he will applaud Bentham's demolition of the usury laws, but will realize the legitimacy of recent endeavors to avoid the unquestioned evil of absolute liberty in loans. He will, in one word, maintain the relativity of theory; he will divest the so-called absolute laws of much of their sanctity, and thus henceforth render impossible the baseless superstition that all problems can be solved by appeal to the fiat of bygone economists.

But, second, we must repudiate the assertion that the new movement is a German movement. The discontent with the continued application of antiquated doctrines made itself felt in the valley of the Po, in the heart of New England, and on the banks of the Thames. It is true that Germans happened to formulate the discontent more systematically at first; but the present movement would ultimately have attained the same proportions had Roscher and Knies never lived, just as Adam Smith would have expressed his ideas had the physiocrats never existed. The new school is the product of the age, of the *zeitgeist*, not of any particular country; for the underlying evolutionary thoughts of a generation sweep resistlessly throughout all countries whose social conditions are ripe for a change. The more extreme of the Germans, moreover, have themselves overshot the mark, have unduly undervalued the work of the English school, and have in their zeal too dogmatically denied the possibility of formulating any general laws.

Finally, we have established the continuity of political economy. The history of economics demonstrates how certain doctrines arose, developed in succeeding generations, and were ultimately overthrown, or, on the contrary, shown to be fundamental truths; how the teachings of successive schools or of individual writers developed the germ of scientific explanation, expanded the law and gradually stripped it of its inaccuracies and redundancies, until many of the complicated

phenomena were shown to be manifestations of distinct and well-settled principles. The doctrine of international exchanges underwent a progressive modification, from Hume, Smith, Say, Ricardo, Mill, to Cairnes and Roscher. The theory of the wages-fund, on the other hand, as formulated by Turgot, Malthus, Senior, and McCulloch, was discredited by Herrmann and Sismondi, until finally overthrown by Longe, Brentano, and Walker; and in like manner with every other principle. The new movement in political economy simply intonates this progressive continuity. It maintains that the explanations of phenomena are inextricably interwoven with the institutions of the period, and that the practical conclusions must not be disassociated from the shifting necessities of the age. We accept with gratitude the results of former economists, as containing much of what was true at the time; but we protest against the acceptance of all their principles as practical guides for the present generation. We use the preliminary results of former decades as forming approximately secure bases; but we desire to erect a structure more suitable to the exigencies of the present. The paramount question of political economy to-day is the question of distribution, and in it the social problem (the question of labor, of the laborer),—how, consistently with a healthy development on the lines of moderate progress, social reform may be accomplished; how and in what degree the chasm between the 'haves' and the 'have-nots' may be bridged over; how and in what degree private initiative and governmental action may strive, separately or conjointly, to lessen the tension of industrial existence, to render the life of the largest social class indeed worth living. This and the other complex problems of the present day cannot be solved by a simple adherence to the principles of a bygone generation. The tenets of a bald individualism have been placed in the scales of experience, and have been found wanting. The continuity of political economy inculcates the lesson, no less profound than salutary, that there still remains something to be learned, and much to be done, before its teachings can be accepted as the loadstars of the present generation,—a lesson whose recognition will preserve us from two violent extremes: that of falling into a state of quiescent conservatism, which regards all that is as good; or that of adopting the vagaries of the radicals, who look upon all that is as bad, and who consider the foundations of the science itself as unsatisfactory as the positive institutions. The continuity of political economy teaches, in other words, the golden mean.

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